

IMPURITY REMOVAL PILOTING FOR THE TECH PROJECT - MANGANESE, ZINC AND CALCIUM REMOVAL, GYPSUM MANAGEMENT, AND TRANSFORMATION AND PURIFICATION SX FOR PRODUCTION OF HIGH PURITY COBALT SULFATE

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ABSTRACT

The Sulfate Refinery in the Queensland Pacific Metals' TECH Project will treat a crude mixed hydroxide precipitate by sulfuric acid leaching, followed by aluminium precipitation, impurity removal, cobalt solvent extraction, nickel solvent extraction, and crystallization of high purity nickel and cobalt sulfate products. All sulfate refinery circuits were piloted sequentially during 2023 at Lakefield, Ontario by SGS Canada.

This paper focusses on the impurity removal circuit which consists of two solvent extraction (SX) circuits that use di (2-ethyl hexyl) phosphoric acid (D2EHPA), dissolved in a high flashpoint aliphatic diluent. These two circuits are Impurity Solvent Extraction (ISX) and the Transformation and Purification (TSX and PSX) circuit. In ISX, impurity metals, including manganese, zinc and calcium, are preferentially extracted over cobalt and nickel. Extraction is followed by scrubbing with sulfuric acid prior to sequential manganese stripping and zinc stripping, both with sulfuric acid. A bleed of zinc-stripped organic is directed to iron stripping using oxalic acid. The ISX raffinate is forwarded to cobalt solvent extraction (CSX) for cobalt recovery.

In transformation, a bleed of the ISX stripped organic is transformed into cobalt-loaded organic. In purification, cobalt-loaded strip liquor (LSL) from CSX is contacted counter-currently with the cobalt loaded organic. The impurity metals from the cobalt LSL displace cobalt from the organic and the raffinate (purified cobalt LSL) is forwarded to cobalt sulfate heptahydrate crystallisation. The impurity removal pilot plant design, operation and results are presented. The feed to ISX is calcium-saturated, leading to gypsum formation in parts of the circuit. The paper discusses the strategies for gypsum management developed during piloting. Purification increased the Co:Mn ratio from 540:1 to >600,000:1, the Co:Zn ratio from 6,000:1 to >66,000:1, and the Co:Cu ratio from 12,000:1 to >50,000:1, and the maximum Ca and Fe in purified cobalt LSL feed to crystallisation were determined to be 10 mg/L and 1.5 mg/L respectively.

Keywords: Queensland Pacific Metals, TECH Project, nickel, cobalt, battery metals, impurity removal, solvent extraction, D2EHPA, manganese, zinc, calcium, iron, oxalic acid, gypsum, cobalt sulfate, transformation, purification